Empowering and engaging factory workers with Operator 4.0 solutions

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Outline of the presentation

- Industry 4.0 and Operator 4.0
- Factory2Fit approach and solutions
  - Video
- Impacts of Operator 4.0 solutions on work well-being
- Case example: Worker Feedback Dashboard

- The research results presented are from H2020 project Factory2Fit (2016-2019)
  www.factory2fit.eu
Industrial work is increasingly mediated; i.e., the work is not related to the physical objects but to their counterparts in the virtual world.
Factory Operator 4.0

Opportunities
- More interesting and versatile jobs
- Work is physically less demanding
- Individual preferences can be taken better into account
- Remote work is increasingly available

Challenges
- How current operators can be supported in learning new skills
- How to tempt young talented people to choose factory work as the career
- Mentally demanding work tasks
- How to maintain the understanding of the physical world and work
Empowering the worker

- Humans and automation take advantage of each others strengths
- Factory systems adapt to the individual skills, capabilities and preferences of the worker
- Workers take responsibility of their own competence development with on-the-job learning
- Workers get encouraging feedback of their well-being and competence development

Operators take ownership of their work with engaging learning and knowledge sharing solutions

Parallel to new technical solutions, new work practices and work environments are co-created

Engaging the work community
Factory2Fit solutions - video

https://www.youtube.com/watch?v=QQcYi8hTwFc&feature=youtu.be
Studying the impacts of Operator 4.0 solutions

Factory2Fit Design and evaluation framework

Antecedents
- User
- Task & Goal
- Tools
- Environment
- Organisation

Immediate Implications
- Ethics
- User Experience
- Usability
- Safety

Impacts
- Well-being at work
  - Job Satisfaction
  - Work Engagement
  - Job Motivation

Company Benefits
- Optimised processes
- Productivity
- Quality
- Desired place to work
Examples of the results of impact assessment studies

**Immediate implications**

- **Ethics**: 15% strongly disagree, 20% disagree, 55% neither agree nor disagree, 10% agree, 10% strongly agree.
- **Safety**: 0% strongly disagree, 40% disagree, 35% neither agree nor disagree, 25% agree, 0% strongly agree.
- **Usability**: 8% strongly disagree, 28% disagree, 58% neither agree nor disagree, 8% agree, 0% strongly agree.
- **Acceptance**: 10% strongly disagree, 40% disagree, 75% neither agree nor disagree, 15% agree, 0% strongly agree.
- **Use Experience**: 10% strongly disagree, 40% disagree, 40% neither agree nor disagree, 10% agree, 0% strongly agree.

**Work well-being and productivity**

- **Productivity**: 60% neither agree nor disagree, 40% agree, 0% strongly agree.
- **Motivation**: 10% strongly disagree, 40% disagree, 50% neither agree nor disagree, 0% agree, 0% strongly agree.
- **Engagement**: 10% strongly disagree, 30% disagree, 60% neither agree nor disagree, 0% agree, 0% strongly agree.
- **Satisfaction**: 20% strongly disagree, 60% disagree, 60% neither agree nor disagree, 20% agree, 0% strongly agree.

**Results of piloting**

**Contextual knowledge sharing at Prima Power**
Impacts of Operator 4.0 solutions on work well-being

- In Factory2Fit project we have studied foreseen impacts of the solutions from the very beginning.
- Paying attention to foreseen impacts on work well-being and productivity has supported identifying wider issues related to the usage of the applications.
- Impact studies have supported the design of both the technical solutions and the new work practices.
- The results of the pilot evaluations show that especially the solutions to engage the work community are expected to have positive impact on work well-being.

Case example: Worker Feedback Dashboard
Worker Feedback Dashboard

Concept

Juxtapose personal and production metrics to:

- Highlight personal achievements for the day
- Track own progress in competence development
- Expand self awareness about the relations between well-being and work performance
Pilots

3 industrial pilot companies

Altogether 10 factory floor workers
- 7 males, 3 females
- Mean 32 years (range 22-50)

Duration: 2-3 months each at the factory shop floor

3 users
Spring 2018
STERA

2 users
Spring 2019
PRP

5 users
Spring 2019
Elekmerk
Immediate implications

Number of respondents: N=8

- Ethics: 63% (Strongly agree), 25% (Agree), 12% (Neither agree nor disagree), 0% (Disagree), 0% (Strongly disagree)
- Safety: 13% (Strongly agree), 25% (Agree), 52% (Neither agree nor disagree), 12% (Disagree), 6% (Strongly disagree)
- Usability: 63% (Strongly agree), 50% (Agree), 0% (Neither agree nor disagree), 0% (Disagree), 0% (Strongly disagree)
- Acceptance: 6% (Strongly agree), 25% (Agree), 75% (Neither agree nor disagree), 0% (Disagree), 0% (Strongly disagree)
- User Experience: 6% (Strongly agree), 81% (Agree), 13% (Neither agree nor disagree), 0% (Disagree), 0% (Strongly disagree)
Perceived benefits

Changes in **daily habits**: Better sleep and more exercise
- "If you sleep badly the day is a mess. When you slept longer the day was better. You could see it also in the utilisation rate of the machine".

Efforts for improving work performance by **concretising accomplishments**
- "I perhaps try a bit more at work as I like to compete (laughs). I have known the ways to do things faster already before, but haven’t put effort on that. As you can’t see it anywhere."

Support in **self-reflection**
- "When I’ve felt that the work day has been hard, I have checked from the data whether it is seen also there (e.g. in the step count)"

Opportunities for **developing ways of working**
- "I was surprised about the quantity of steps during the work day. This means that there would be an opportunity for development, that the material needed haven’t been easily available, and you have had to search for them."
Conclusions of piloting Worker Feedback Dashboard

- The concept was found novel but interesting
- It is challenging to find measurable indicators for work achievements
- Ethical aspects, privacy concerns and potential impacts on all stakeholders shall be addressed when introducing Worker Feedback Dashboard
- Workers should locally participate in planning how to utilize Worker Feedback Dashboard, and what kind of work practices should be agreed related to its use
- Worker Feedback Dashboard seems to have potential lead users, so could be introduced via them, showing encouraging example to others
- Still, using Worker Feedback Dashboard should be voluntary
Thank you for your attention

Any questions?

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